

FIG. 1

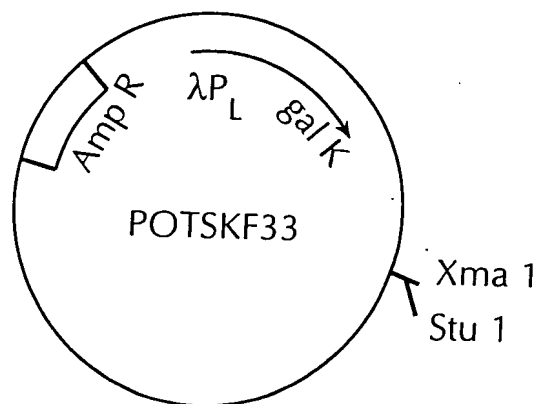


FIG. 2

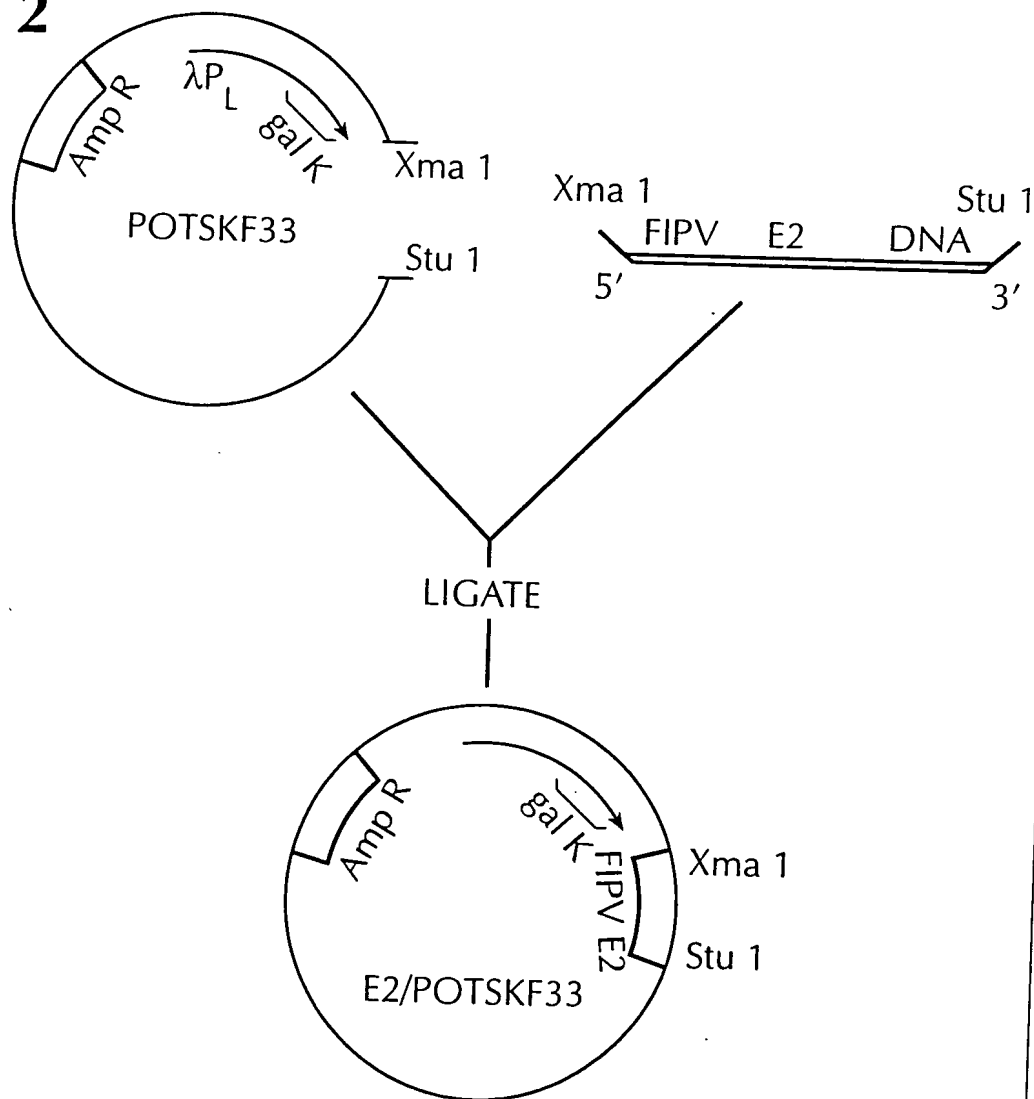


FIG. 3A

AR58-3 PCR expression clone

SEQ ID NO: 19- nucleotide sequence

SEQ ID NO: 20- amino acid sequence

ATG GAT CCC GAA TTC CAA GAA AAA ACA CAA TCT CTG TTT	39
Met Asp Pro Glu Phe Gln Glu Lys Thr	10
1	
GCC AAC GCA TTT GGC TAC CCT GCC ACT CAC ACC ATT CAG	78
Ala Asn Ala Phe Gly Tyr Pro Ala Thr His Thr Ile Gln	25
15	
GGC CCT GGC CGC GTG AAT TTG ATT GGT GAA CAC ACC GAC	117
Ala Pro Gly Arg Val Asn Leu Ile Gly Glu His Thr Asp	35
30	
TAC AAC GAC GGT TTC GTT CTG CCC TGC GCG ATT GAT TAT	156
Tyr Asn Asp Gly Phe Val Leu Pro Cys Ala Ile Asp Tyr	50
40	
CAA ACC GTG ATC CCT AAT ACC CGG GGC ACT GGT AAT GCA	195
Gln Thr Val Ile Pro Asn Thr Arg Gly Thr Gly Asn Ala	65
55	
first FIPV aa	
CGT GGT AAA CCA TTA TTA TTT CAT GTG CAT GGT GAG CCT	234
Arg Gly Lys Pro Leu Leu Phe His Val His Gly Glu Pro	75
70	
GTT AGT GTT ATT ATA TAT ATA TCG GCT TAT AGG GAT GAT	273
Val Ser Val Ile Ile Tyr Ile Ser Ala Tyr Arg Asp Asp	90
80	

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Last FIPV aa

FIG. 4A

DF2 FIPV, nucleotides 1- 4365 [SEQ ID NO:21]
 DF2 FIPV, amino acid 1- 1454 [SEQ ID NO:22]

DF2-HP, nucleotides* 1- 2246 [SEQ ID NO:23]
DF2-HP, amino acids* 1- 748 [SEQ ID NO:24]

ATG ATT GTG CTC GTA ACT TGC CTC TTG TTG TTA TGT TCA TAC CAC ACA	48
Met Ile Val Leu Val Thr Cys Leu Leu Cys Ser Tyr His Thr	15
1	
GTT TTG AGT ACA ACA AAT AAT GAA TGC ATA CAA GTT AAC GTA ACA CAA	96
Val Leu Ser Thr Thr Asn Asn Glu Cys Ile Gln Val Asn Val Thr Gln	30
20	
TTG GCT GGC AAT GAA AAC CTT ATC AGA GAT TTT CTG TTT AGT AAC TTT	144
Leu Ala Gly Asn Glu Asn Leu Ile Arg Asp Phe Leu Phe Ser Asn Phe	45
35	
AAA GAA GAA GGA AGT GTA GTT GTT GGT GGT TAT TAC CCT ACA GAG GTG	192
Lys Glu Glu Gly Ser Val Val Val Gly Gly Tyr Tyr Pro Thr Glu Val	60
50	
T* G*	
TGG TAC AAC TGC TCT AGA ACA GCA CAA ACT ACT GCC TTT CAG TAT TTT	240
Trp Tyr Asn Cys Ser Arg Thr Ala Gln Thr Thr Ala Phe Tyr Phe	80
65	
Arg*	
AAT AAT ATA CAT GCC TTT TAT TTT GTT ATG GAA GCC ATG GAA AAT AGC	288
Asn Asn Ile His Ala Phe Tyr Phe Val Met Glu Ala Met Glu Asn Ser	95
85	

FIG. 4B

ACT GGT AAT GCA CGT GGT AAA CCA TTA TTA TTT CAT GTG CAT GGT GAG 336
 Thr Gly Asn Ala Arg Gly Lys Pro Leu Leu Phe His Val His Gly Glu
 ↑ 100 105 110
 97 of WSU 1146
 FIPV in 58-3;
 AR58-3 amino acid #62

CCT GTT AGT GTT ATT ATA TAT ATA TCG GCT TAT AGG GAT GAT GTG CAA 384
 Pro Val Ser Val Ile Ile Tyr Ile Ser Ala Tyr Arg Asp Asp Val Gln
 115 120 125

CAA AGG CCC CTT TTA AAA CAT GGG TTA GTG TGC ATA ACT AAA AAT CGC 432
 Gln Arg Pro Leu Leu Lys His Gly Leu Val Cys Ile Thr Lys Asn Arg
 130 Glu*135 140

CAT ATT AAC TAT GAA CAA TTC ACC TCC AAC CAG TGG AAT TCC ACA TGT 480
 His Ile Asn Tyr Glu Gln Phe Thr Ser Asn Gln Trp Asn Ser Thr Cys
 145 150 ↑ 155 160
 AR58-3 AR58-3
 a.a. #116 a.a. #118

ACG GGT GCT GAC AGA AAA ATT CCT TTC TCT GTC ATA CCC ACG GAC AAT 528
 Thr Gly Ala Asp Arg Lys Ile Pro Phe Ser Val Ile Pro Thr Asp Asn
 165 170 175

GGA ACA AAA ATC TAT GGT CTT GAG TGG AAT GAT GAC TTT GTT ACA GCT 576
 Gly Thr Lys Ile Tyr Gly Leu Glu Trp Asn Asp Asp Phe Val Thr Ala
 180 185 190

TAT ATT AGT GGT CGT TCT TAT CAC TTG AAC ATC AAT ACT AAT TGG TTT 624
 Tyr Ile Ser Gly Arg Ser Tyr His Leu Asn Ile Asn Thr Asn Trp Phe
 195 200 ↑ 205
 AR58-3
 a.a. #164

FIG. 4C

AAC AAT GTC ACA CTT TTG TAT TCA CGC TCA AGC ACT GCT ACC TGG GAA 672	
Asn 210 Val Thr Leu Leu 215 Tyr Ser Arg Ser Thr Ala Thr Trp Glu	
TAC AGT GCT GCA TAT GCT TAC CAA GGT GTT TCT AAC TTC ACT TAT TAC 720	
Tyr Ser Ala Ala Tyr Ala Tyr Gln Gly Val Ser Asn Phe Thr Tyr Tyr 240	
225	
AAG TTA AAT AAC ACC AAT GGT CTA AAA ACC TAT GAA TTA TGT GAA GAT 768	
Lys Leu Asn Asn Thr Asn Gly Leu Lys Thr Tyr Glu Leu Cys Glu Asp 255	
245	
TAT GAA CAT TGC ACT GGC TAT GCT ACC AAT GTA TTT GCT CCG ACA TCA 816	
Tyr Glu His Cys Thr Gly Tyr Ala Thr Asn Val Phe Ala Pro Thr Ser 270	
260	
GGT GGT TAC ATA CCT GAT GGA TTT AGT TTT AAC AAT TGG TTC TTG CTT 864	
Gly Gly Tyr Ile Pro Asp Gly Phe Ser Phe Asn Asn Trp Phe Leu Leu 285	
275	
ACA AAT AGT TCC ACT TTT GTT AGT GGC AGG TTT GTA ACA AAT CAA CCA 912	
Thr Asn Ser Ser Thr Phe Val Ser Gly Arg Phe Val Thr Asn Gln Pro 300	
290	
TTA TTG ATT AAT TGC TTG TGG CCA GTG CCC AGT TTT GGT GTA GCA GCA 960	
Leu Leu Ile Asn Cys Leu Trp Pro Val Pro Ser Phe Gly Val Ala Ala 320	
305	
CAA GAA TTT TGT TTT GAA GGT GCA CAG TTT AGC CAA TGT AAT GGT GTG 1008	
Gln Glu Phe Cys Phe Glu Gly Ala Gln Phe Ser Ser Gln Cys Asn Gly Val 335	
325	
330	

T*

FIG. 4D

TCT Ser	TTA Leu	AAT Asn	AAC Asn	ACA Thr	GTG Val	GAT Asp	GTT Val	ATT Ile	AGA Arg	TTC Phe	AAC Asn	CTT Leu	AAT Asn	TTC Phe	ACT Thr	1056
			340					345				350				
GCA Ala	GAT Asp	GTA Val	CAA Gln	TCT Ser	GGT Gly	ATG Met	GGT Gly	GCT Ala	ACA Thr	GTA Val	TTT Phe	TCA Ser	CTG Leu	AAT Asn	ACA Thr	1104
		355					360					365				
ACA Thr	GGT Gly	GGT Gly	GTC Val	ATT Ile	CTT Leu	GAA Glu	ATT Ile	TCA Ser	TGT Cys	TAT Tyr	AGT Ser	GAC Asp	ACA Thr	GTG Val	AGT Ser	1152
	370					375					380					
GAG Glu	TCT Ser	AGT Ser	TCT Ser	TAC Tyr	AGT Ser	TAT Tyr	GGT Gly	GAA Glu	ATC Ile	CCG Pro	TTC Phe	GGC Gly	ATA Ile	ACT Thr	ASP	1200
	385				390					395					400	
GGA Gly	CCA Pro	CGA Arg	TAC Tyr	TGT Cys	TAT Tyr	GTA Val	CTT Leu	TAC Tyr	AAT Asn	GGC Gly	ACA Thr	GCT Ala	CTT Leu	AAA Lys	TAT Tyr	1248
			405						410					415		
TTA Leu	GGA Gly	ACA Thr	TTA Leu	CCA Pro	CCC Pro	AGT Ser	GTA Val	AAG Lys	GAA Glu	ATT Ile	GCT Ala	ATT Ile	AGT Ser	AAG Lys	TGG Trp	1296
			420					425					430			

C*

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FIG. 4E

GGC CAT TTT TAT ATT AAT GGT TAC AAT TTC TTT AGC ACA TTT CCT ATT	1344
Gly His Phe Tyr Ile Asn Gly Tyr Asn Phe Phe Thr Ser Thr Phe Pro Ile	445
435	
T*	
GGT TGT ATA TCT TTT AAT TTA ACC ACT GGT GCT AGT GGA GCT TTT TGG	1392
Gly Cys Ile Ser Phe Asn Leu Thr Thr Thr Ala Ser Gly Ala Phe Trp	
450	Val* 460
ACA ATT GCT TAC ACA TCG TAT ACT GAA GCA TTA GTA CAA GTT GAA AAC	1440
Thr Ile Ala Tyr Thr Ser Tyr Thr Glu Ala Leu Val Gln Val Glu Asn	480
465	
ACA GCT ATT AAA AAT GTG ACG TAT TGT AAC AGT CAC ATT AAT AAC ATT	1488
Thr Ala Ile Lys Asn Val Thr Tyr Cys Asn Ser His Ile Asn Asn Ile	495
485	
AAA TGT TCT CAA CTT ACT GCT AAT TTG AAT AAT GGA TTT TAT CCT GTT	1536
Lys Cys Ser Gln Leu Thr Thr Ala Asn Leu Asn Asn Gly Phe Tyr Pro Val	510
500	
GCT TCA AGT GAA GTA GGT TTC GTT AAT AAG AGT GTT GTG TTA TTA CCT	1584
Ala Ser Ser Glu Val Gly Phe Val Asn Lys Ser Val Val Leu Leu Pro	525
515	
T*	
AGC TTT TTC ACA CAC ACC GCT GTC AAT ATA ACC ATT GAT CTT GGT ATG	1632
Ser Phe Phe Thr His Thr Ala Val Asn Ile Thr Ile Asp Leu Gly Met	
530	Tyr* 540

FIG. 4F

AAG Lys 545	CTT Leu	AGT Ser	TAT Tyr	GGT Gly	CAA Gln	CCC Pro	ATA Ile	GCC Ala	TCG Ser	ACA Thr	CTA Leu	AGT Ser	AAC Asn	ATC Ile	1680
ACA Thr	CTA Leu	CCA Pro	ATG Met	CAG Gln	GAT Asp	AAC Asn	ACT Thr	GAT Asp	GTG Val	TAC Tyr	TGT Cys	ATT Ile	CGT Arg	TCT Ser	1728
AAC Asn	CAA Gln	TTC Phe	TCA Ser	GTT Val	TAT Tyr	GTT Val	CCT Pro	ACT Thr	TGC Cys	AAA Lys	AGT Ser	TCT Ser	TTA Leu	TGG Trp	1776
GAC Asp	AAT Asn	TTT Phe	TTT Thr	AAT Asn	CAA Gln	GAC Asp	TGC Cys	ACG Thr	GAT Asp	TTA Leu	GAG Glu	GCT Ala	ACA Thr	GCT Ala	1824
GTT Val	ATA Ile	AAA Lys	ACT Thr	GGT Gly	ACT Thr	TGT Cys	CCT Pro	TTC Phe	TCA Ser	GAT Asp	AAA Lys	TTG Leu	AAC Asn	AAT Asn	1872
TAC Tyr	TTG Leu	ACT Thr	TTT Phe	AAC Asn	AAG Lys	TTC Phe	TGT Cys	TTG Leu	TCG Ser	TTG Leu	CCT Pro	GTT Val	GGT Gly	GCT Ala	1920
AAT Asn	TGC Cys	AAG Lys	TTT Phe	GAT Asp	GTT Val	GCT Ala	GCA Ala	CGT Arg	ACA Thr	ACC Thr	AAT Asn	GAG Glu	CAG Gln	GTT Val	1968
GTT Val	AGA Arg	AGT Ser	CTA Leu	TAT Tyr	GTA Val	ATA Ile	TAT Tyr	GAA Glu	GGA Gly	GAC Asp	AAC Asn	ATA Ile	GTG Val	GGT Gly	2016

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FIG. 4G

GTA	CCG	TCT	GAT	AAT	AGC	GGT	CTG	CAC	GAT	TTG	TCT	GTG	CTA	CAC	CTA	2064
Val	Pro	Ser	Asp	Asn	Ser	Gly	Leu	His	Asp	Leu	Ser	Val	Leu	His	Leu	
		675				680						685				
G*																
Asp																
GAC	TCC	TGT	ACA	GAT	TAC	AAT	ATA	TAT	GGT	AGA	ACT	GGT	GTT	GGT	ATT	2112
Asp	Ser	Cys	Thr	Asp	Tyr	Asn	Ile	Tyr	Gly	Arg	Thr	Gly	Val	Gly	Ile	
	690					695					700					
ATT	AGA	CGA	ACT	AAC	AGT	ACG	CTA	CTT	AGT	GGC	TTA	TAT	TAC	ACA	TCA	2160
Ile	Arg	Arg	Thr	Asn	Ser	Thr	Leu	Leu	Ser	Gly	Leu	Tyr	Tyr	Thr	Ser	
	705				710					715					720	
CTA	TCA	GGT	GAT	TTG	TTA	GGC	TTT	AAA	AAT	GTT	AGT	GAT	GGT	GTC	ATT	2208
Leu	Ser	Gly	Asp	Leu	Leu	Gly	Phe	Lys	Asn	Val	Ser	Asp	Gly	Val	Ile	
			725						730					735		
TAT	TCT	GTG	ACG	CCA	TGT	GAT	GTA	AGC	GCA	CAA	GCG	GCT	GTT	ATT	GAT	2256
Tyr	Ser	Val	Thr	Pro	Cys	Asp	Val	Ser	Ala	Gln	Ala	Ala	Val	Ile	Asp	
			740					745					750			
GGT	GCC	ATA	GTT	GGA	GCT	ATG	ACT	TCC	ATT	AAC	AGT	GAA	CTG	TTA	GGT	2304
Gly	Ala	Ile	Val	Gly	Ala	Met	Thr	Ser	Ile	Asn	Ser	Glu	Leu	Leu	Gly	
		755				760						765				
CTA	ACA	CAT	TGG	ACA	ACG	ACA	CCT	AAT	TT~	TAT	TAC	TAC	TCT	ATA	TAT	2352
Leu	Thr	His	Trp	Thr	Thr	Thr	Pro	Asn	Ph~	Tyr	Tyr	Tyr	Ser	Ile	Tyr	
						775				780						
AAT	TAC	ACA	AGT	GAG	AGG	ACT	CGT	GGC	ACT	GCA	ATT	GAC	AGT	AAC	GAT	2400
Asn	Tyr	Thr	Ser	Glu	Arg	Thr	Arg	Gly	Tht	Ala	Ile	Asp	Ser	Asn	Asp	
	785				790					795					800	

FIG. 4H

GTT GAT TGT GAA CCT GTC ATA ACC TAT TCT AAT ATA GGT GTT TGT AAA	2448
Val Asp Cys Glu Pro Val Ile Thr Tyr Ser Asn Ile Gly Val Cys Lys	815
AAT GGT GCT TTG GTT TTT ATT AAC GTC ACA CAT TCT GAC GGA GAC GTG	2496
Asn Gly Ala Leu Val Phe Ile Asn Val Thr His Ser Asp Gly Asp Val	830
CAA CCA ATT AGC ACT GGT AAT GTC ACG ATA CCT ACA AAT TTT ACC ATA	2544
Gln Pro Ile Ser Thr Gly Asn Val Thr Ile Pro Thr Asn Phe Thr Ile	845
TCT GTG CAA GTT GAA TAC ATG CAG GTT TAC ACT ACA CCA GTA TCA ATA	2592
Ser Val Gln Val Glu Tyr Met Gln Val Tyr Thr Thr Pro Val Ser Ile	860
GAT TGT GCA AGA TAC GTT TGT AAT GGT AAC CCT AGA TGT AAC AAA TTG	2640
Asp Cys Ala Arg Tyr Val Cys Asn Gly Asn Pro Arg Cys Asn Lys Leu	880
TTA ACA CAA TAT GTG TCT GCA TGT CAA ACT ATT GAA CAA GCA CTT GCA	2688
Leu Thr Gln Tyr Val Ser Ala Cys Gln Thr Ile Glu Gln Ala Leu Ala	895
ATG GGT GCC AGA CTT GAA AAC ATG GAG GTT GAT TCC ATG TTG TTT GTC	2736
Met Gly Ala Arg Leu Glu Asn Met Glu Val Asp Ser Met Leu Phe Val	910

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FIG. 4I

TCG GAA AAT AAT GCC CTT AAA TTG GCA TCT GTT GAG GCG TTC AAT AGT ACA 2784	Ser Glu Asn Ala Leu Lys Leu Ala Ser Val Glu Ala Phe Asn Ser Thr	915 920 925
GAA AAT TTA GAT CCT ATT TAC AAA GAA TGG CCT AGC ATA GGT GGT TCT 2832	Glu Asn Leu Asp Pro Ile Tyr Lys Glu Trp Pro Ser Ile Gly Gly Ser	930 935 940
TGG CTA GGA GGT CTA AAA GAT ATA CTA CCG TCC CAT AAT AGC AAA CGT 2880	Trp Leu Gly Gly Leu Lys Asp Ile Leu Pro Ser His Asn Ser Lys Arg	945 950 955 960
AAG TAT GGT TCT GCT ATA GAA GAT TTG CTT TTT GAT AAA GTT GTA ACA 2928	Lys Tyr Gly Ser Ala Ile Glu Asp Leu Leu Phe Asp Lys Val Val Thr	965 970 975
TCT GGT TTA GGT ACA GTT GAT GAA GAT TAT AAA CGT TGT ACT GGT GGT 2976	Ser Gly Leu Gly Thr Val Asp Glu Asp Tyr Lys Arg Cys Thr Gly Gly	980 985 990
TAC GAC ATA GCA GAC TTG GTG TGT GCT CAA TAT TAC AAT GGC ATC ATG 3024	Tyr Asp Ile Ala Asp Leu Val Cys Ala Gln Tyr Tyr Asn Gly Ile Met	995 1000 1005
GTT CTA CCA GGT GTA GCT AAT GCT GAC AAG ATG ACT ATG TAC ACA GCA 3072	Val Leu Pro Gly Val Ala Asn Ala Asp Lys Met Thr Met Tyr Thr Ala	1010 1015 1020
TCA CTT GCA GGT GGT ATA ACA TTA GGT GCA CTT GGT GGT GCC GTG 3120	Ser Leu Ala Gly Gly Ile Thr Leu Gly Ala Leu Gly Gly Gly Ala Val	1025 1030 1035 1040

FIG. 4J

GCT ATA CCT TTT GCA GTA GCA GTA CAG GCT AGA CTT AAT TAT GTT GCT	3168
Ala Ile Pro Phe Ala Val Ala Val Gln Ala Arg Leu Asn Tyr Val Ala	1055
	1045
CTA CAA ACT GAT GTA TTG AAT AAA AAC CAA CAG ATC CTG GCT AAT GCT	3216
Leu Gln Thr Asp Val Leu Asn Lys Asn Gln Gln Ile Leu Ala Asn Ala	1070
	1065
TTC AAT CAA GCT ATT GGT AAC ATT ACA CAG GCT TTT GGT AAG GTT AAT	3264
Phe Asn Gln Ala Ile Gly Asn Ile Thr Gln Ala Phe Gly Lys Val Asn	1085
	1080
GAT GCT ATA CAT CAA ACA TCA CAA GGT CTT GCC ACT GTT GCT AAA GCG	3312
Asp Ala Ile His Gln Thr Ser Gln Gly Leu Ala Thr Val Ala Lys Ala	1100
	1095
TTG GCA AAA GTG CAA GAT GTT GTC AAC ACA CAA GGG CAA GCT TTA AGT	3360
Leu Ala Lys Val Gln Asp Val Val Asn Thr Gln Gly Gln Ala Leu Ser	1120
	1110
CAC CTT ACA GTA CAA TTG CAA AAT AAT TTT CAA GCC ATT AGT AGT TCT	3408
His Leu Thr Val Gln Leu Gln Asn Asn Phe Gln Ala Ile Ser Ser Ser	1135
	1125
ATT AGT GAT ATT TAT AAC AGG CTT GAC GAA CTG AGT GCT GCA CAA	3456
Ile Ser Asp Ile Tyr Asn Arg Leu Asp Glu Leu Ser Ala Asp Ala Gln	1150
	1140
GTT GAT AGG CTG ATT ACA GGT AGA CTT ACA GCA CTT AAT GCA TTT GTG	3504
Val Asp Arg Leu Ile Thr Gly Arg Thr Ala Leu Asn Ala Phe Val	1165
	1155
	1160

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FIG. 4K

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TCT CAG ACT CTA ACC AGA CAA GCA GAG GTT AGG GCT AGT AGA CAA CTT	3552
Ser Gln Thr Leu Thr Arg Gln Ala Glu Val Arg Ala Ser Arg Gln Leu	1170 1175 1180
GCC AAA GAC AAG GTT AAT GAA TGT GTT AGG TCT CAG TCT CAG AGA TTC	3600
Ala Lys Asp Lys Val Asn Glu Cys Val Arg Ser Gln Ser Gln Arg Phe	1185 1190 1195 1200
GGA TTC TGT GGT AAT GGT ACA CAT TTG TTT TCA CTA GCA AAT GCA GCA	3648
Gly Phe Cys Gly Asn Gly Thr His Leu Phe Ser Leu Ala Asn Ala Ala	1205 1210 1215
CCA AAT GGC ATG ATT TTC TTT CAT ACA GTA CTA TTA CCA ACA GCT TAT	3696
Pro Asn Gly Met Ile Phe Phe His Thr Val Leu Leu Pro Thr Ala Tyr	1220 1225 1230
GAA ACT GTA ACA GCT TGG TCA GGT ATT TGT GCT TCA GAT GGC GAT CGC	3744
Glu Thr Val Thr Ala Trp Ser Gly Ile Cys Ala Ser Asp Gly Asp Arg	1235 1240 1245
ACT TTC GGA CTT GTC GTT AAA GAT GTG CAG TTG ACG TTG TTT CGT AAT	3792
Thr Phe Gly Leu Val Val Lys Asp Val Gln Leu Thr Leu Phe Arg Asn	1250 1255 1260
CTA GAT GAC AAG TTC TAT TTG ACC CCC AGA ACT ATG TAT CAG CCT AGA	3840
Leu Asp Asp Lys Phe Tyr Leu Thr Pro Arg Thr Met Tyr Gln Pro Arg	1265 1270 1275 1280
GTT GCA ACT AGT TCT GAT TTT GTT CAA ATT GAA GGG TGT GAT GTG TTG	3888
Val Ala Thr Ser Ser Asp Phe Val Gln Ile Glu Gly Cys Asp Val Leu	1285 1290 1295
TTT GTC AAC GCG ACT GTA ATT GAT TTG CCT AGT ATT ATA CCT GAC TAT	3936
Phe Val Asn Ala Thr Val Ile Asp Leu Pro Ser Ile Ile Pro Asp Tyr	1300 1305 1310

FIG. 4L

ATT GAC ATT AAT CAA ACT GTT CAA GAC ATA TTA GAA AAT TAC AGA CCA 3984
 Ile Asp 1315 Ile Asn Gln Thr Val Gln Asp 1320 Tyr Arg Pro 1325

 AAC TGG ACT GTA CCT GAA TTT ACA CTT GAT ATT TTC AAC GCA ACC TAT 4032
 Asn Trp Thr Val Pro Glu Phe Thr Leu Asp Ile Phe Asn Ala Thr Tyr 1340
 1330

 TTA AAT CTG ACT GGT GAA ATT GAT GAC TTA GAG TTT AGG TCA GAA AAG 4080
 Leu Asn Leu Thr Gly Glu Ile Asp Asp Leu Glu Phe Arg Ser Glu Lys 1360
 1345

 CTA CAT AAC ACT ACA GTA GAA CTT GCC ATT CTC ATT GAT ACC ATT AAT 4128
 Leu His Asn Thr Thr Val Glu Leu Ala Ile Leu Ile Asp Thr Ile Asn 1375
 1365

 AAT ACA TTA GTC AAT CTT GAA TGG CTC AAT AGA ATT GAA ACT TAT GTA 4176
 Asn Thr Leu Val Asr Leu Glu Trp Leu Asn Arg Ile Glu Thr Tyr Val 1385 1390
 1380

 AAA TGG CCT TGG TAT GTG TGG CTA CTG ATA GGT CTA GTA GTA TTT 4224
 Lys Trp Pro Trp Tyr Val Trp Leu Leu Ile Gly Leu Val Val Phe 1405
 1395

 TGC ATA CCA TTA CTG CTA TTT TGC TGT TTT AGC ACA GGT TGT TGT GGA 4272
 Cys Ile Pro Leu Leu Leu Phe Cys Cys Phe Ser Thr Gly Cys Cys Gly 1420
 1410

 TGC ATA GGT TGT TTA GGA AGT TGT TGT CAC TCT ATA TGT AGT AGA AGA 4320
 Cys Ile Gly Cys Leu Gly Ser Cys Cys His Ser Ile Cys Ser Arg Arg 1440
 1425

 CAA TTT GAA TAT TAT GAA CCA ATT GAA AAA GTG CAT GTC CAC 4362
 Gln Phe Glu Tyr Tyr Glu Pro Ile Glu Lys Val His Val His 1450
 1445

 TAA 4365

FIG. 5A

TS FIPV, nucleotides 1- 4365 [SEQ ID NO: 25]
 TS FIPV, amino acids 1- 1454 [SEQ ID NO: 26]

TS-BP, nucleotides* 1- 2246 [SEQ ID NO:27]
TS-BP, amino acids* 1- 748 [SEQ ID NO:28]

ATG ATT GTG CTC GTA ACT TGC CTC TTG TTG TTA TGT TCA TAC CAC ACA	48
Met Ile Val Leu Val Thr Cys Leu Leu Cys Ser Tyr His Thr	15
1	
GTT TTG AGT ACA ACA AAT AAT GAA TGC ATA CAA GTT AAC GTT ACA CAA	96
Val Leu Ser Thr Thr Asn Asn Glu Cys Ile Gln Val Asn Val Thr Gln	30
20	
TTG GCT GGC AAT GAA AAC CTT ATC AGA GAT TTT CTG TTT AGT AAC TTT	144
Leu Ala Gly Asn Glu Asn Leu Ile Arg Asp Phe Leu Phe Ser Asn Phe	45
35	
AAA GAA GAA GGA AGT GTA GTT GTT GGT GGT TAT TAC CCT ACA GAG GTG	192
Lys Glu Glu Gly Ser Val Val Val Gly Gly Tyr Tyr Pro Thr Glu Val	60
50	
TGG TAC AAC TGC TCT AGA ACA GCT CGA ACT ACT GCC TTT CAG TAT TTT	240
Trp Tyr Asn Cys Ser Arg Thr Ala Arg Thr Thr Ala Phe Gln Tyr Phe	80
65	
AAT AAT ATA CAT GCC TTT TAT TTT GTT ATG GAA GCC ATG GAA AAT AGC	288
Asn Asn Ile His Ala Phe Tyr Phe Val Met Glu Ala Met Glu Asn Ser	95
85	

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FIG. 5B

ACT GGT AAT GCA CGT GGT AAA CCA TTA TTA TTT CAT GTG CAT GGT GAG	336
Thr Gly Asn Ala Arg Gly Lys Pro Leu Leu Phe His Val His Gly Glu	110
↑	100
97 of WSU 1146	105
FIPV in 58-3	
corresponds to amino acid #62 of AR58-3	
CCT GTT AGT GTT ATT ATA TAT ATA TCG GCT TAT AGG GAT GAT GTG CAA	384
Pro Val Ser Val Ile Ile Tvr Ile Ser Ala Tvr Arg Asp Asp Val Gln	125
115	120
CAA AGG CCC CTT TTA AAA CAT GGG TTA GTG TGC ATA ACT AAA AAT CGC	432
Gln Arg Pro Leu Leu Lys His Gly Leu Val Cys Ile Thr Lys Asn Arg	140
130	135
CAT ATT AAC TAT GAA CAA TTC ACC TCC AAC CAG TGG AAT TCC ACA TGT	480
His Ile Asn Tvr Glu Gln Phg Thr Ser Asn Gln Trp Asn Ser Thr Cys	160
145	150
↑	155
AR58-3	AR58-3
a.a. #116	a.a. #118
ACG GGT GCT GAC AGA AAA ATT CCT TTC TCT GTC ATA CCC ACG GAC AAT	528
Thr Gly Ala Asp Arg Lys Ile Pro Phe Ser Val Ile Pro Thr Asp Asn	175
165	170
GGA ACA AAA ATC TAT GGT CTT GAG TGG AAT GAT GAC TTT GTT ACA GCT	576
Gly Thr Lys Ile Tyr Gly Leu Glu Trp Asn Asp Phe Val Thr Ala	190
180	185

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FIG. 5C

TAT ATT AGT GGT CGT TCT TAT CAC TTG AAC ATC AAT ACT AAT TGG TTT	624
Tyr Ile Ser Gly Ara Ser Tyr His Leu Asn Ile Asn Thr Asn Trp Phe	
195	200
	205
AAC AAT GTC ACA CTT TTG TAT TCA CGC TCA AGC ACT GCT ACC TGG GAA	672
Asn Asn Val Thr Leu Leu Tyr Ser Tyr Ser Ara Ser Ser Thr Ala Thr Trp Glu	
210	215
	220
	↑
FIPV amino acid	
#223 from WSU 1146;	
AR58-3 a.a. #189	
TAC AGT GCT GCA TAT GCT TAC CAA GGT GTT TCT AAC TTC ACT TAT TAC	720
Tyr Ser Ala Ala Tyr Ala Tyr Gln Gly Val Ser Asn Phe Thr Tyr Tyr	240
225	235
AAG TTA AAT AAC ACC AAT GGT CTA AAA ACC TAT GAA TTA TGT GAA GAT	768
Lys Leu Asn Asn Thr Asn Gly Leu Lys Thr Tyr Glu Leu Cys Glu Asp	
	250
	255
TAT GAA CAT TGC ACT GGC TAT GCT ACC AAT GTA TTT GCT CCG ACA TCA	816
Tyr Glu His Cys Thr Asn Gly Tyr Ala Thr Asn Val Phe Ala Pro Thr Ser	
	260
	265
GGT GGT TAC ATA CCT GAT GGA TTT AGT TTT AAT AAT TGG TTC TTG CTT	864
Gly Gly Tyr Ile Pro Asp Gly Phe Ser Phe Asn Asn Trp Phe Leu Leu	
	270
	275
ACA AAT AGT TCC ACT TTT GTT AGT GGC AGG TTT GTA ACA AAT CAA CCA	912
Thr Asn Ser Ser Thr Phe Val Ser Gly Arg Phe Val Thr Asn Gln Pro	
290	295
	300

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FIG. 5D

TTA	TTG	ATT	AAT	TGC	TTG	TGG	CCA	GTG	CCC	AGT	TTT	GGT	GTA	GTA	GCA	960
Leu	Leu	Ile	Asn	Cys	Leu	Trp	Pro	Val	Pro	Ser	Phe	Gly	Val	Val	Ala	
305					310					315					Ala*320	
CAA	GAA	TTT	TGT	TTT	GAA	GGT	GCA	CAG	TTT	AGC	CAA	TGT	AAT	GGT	GTG	1008
Gln	Glu	Phe	Cys	Phe	Glu	Gly	Ala	Gln	Phe	Ser	Gln	Cys	Asn	Gly	Val	
				325				330						335		
TCT	TTA	AAT	AAC	ACA	GTG	GAT	GTT	ATT	AGA	TTC	AAC	CTT	AAT	TTC	ACT	1056
Ser	Leu	Asn	Asn	Thr	Val	Asp	Val	Ile	Arg	Phe	Asn	Leu	Asn	Phe	Thr	
			340					345					350			
GCA	GAT	GTA	CAA	TCT	GGT	ATG	GGT	GCT	ACA	GTA	TTT	TCA	CTG	AAT	ACA	1104
Ala	Asp	Val	Gln	Ser	Gly	Met	Gly	Ala	Thr	Val	Phe	Ser	Leu	Asn	Thr	
		355					360					365				
ACA	GGT	GGT	GTC	ATT	CTT	GAA	ATT	TCA	TGT	TAT	AGT	GAC	ACA	GTG	AGT	1152
Thr	Gly	Gly	Val	Ile	Leu	Glu	Ile	Ser	Cys	Tyr	Ser	Asp	Thr	Val	Ser	
		370				375					380					
GAG	TCT	AGT	TCT	TAC	AGT	TAT	GGT	GAA	ATC	CCG	TTC	GGC	ATA	ACT	GAC	1200
Glu	Ser	Ser	Ser	Tyr	Ser	Tyr	Gly	Glu	Ile	Pro	Phe	Gly	Ile	Thr	Asp	
385					390					395					400	
GGA	CCA	CGA	TAC	TGT	TAT	GTA	CTT	TAC	AAT	GGC	ACA	GCT	CTT	AAA	TAT	1248
Gly	Pro	Arg	Tyr	Cys	Tyr	Val	Leu	Tyr	Asn	Gly	Thr	Ala	Leu	Lys	Tyr	
				405					410					415		
TTA	GGA	ACA	TTA	CCA	CCC	AGT	GTA	AAG	GAA	ATT	GCT	ATT	AGT	AAG	TGG	1296
Leu	Gly	Thr	Leu	Pro	Pro	Ser	Val	Lys	Glu	Ile	Ala	Ile	Ser	Lys	Trp	
			420					425					430			

FIG. 5E

GGC CAT TTT TAT ATT AAT GGT TAC AAT TTC TTT AGC ACA TTT CCT ATT 1344 Gly His Phe 435 Tyr Ile Asn Gly Tyr Asn Phe Phe Thr Phe Pro Ile
GAT TGT ATA TCT TTT AAT TTA ACC ACT GGT GTT AGT GGA GCT TTT TGG 1392 Asp Cys Ile Ser Phe Asn Leu Thr Thr Gly Val Ser Gly Ala Phe Trp
ACA ATT GCT TAC ACA TCG TAT ACT GAA GCA TTA GTA CAA GTT GAA AAC 1440 Thr Ile Ala Tyr Thr Ser Tyr Thr Glu Ala Leu Val Gln Val Glu Asn 480
ACA GCT ATT AAA AAT GTG ACG TAT TGT AAC AGT CAC ATT AAT AAC ATT 1488 Thr Ala Ile Lys Asn Val Thr Thr Cys Asn Ser His Ile Asn Asn Ile 495
AAA TGT TCT CAA CTT ACT GCT AAT TTG AAT AAT AAT GGA TTT TAT CCT GTT 1536 Lys Cys Ser Gln Leu Thr Thr Ala Asn Leu Asn A9n Gly Phe Tyr Pro Val 510
GCT TCA AGT GAA GTA GGT TTC GCT AAT AAT AAG AGT GTT GTG TTA TTA CCT 1584 Ala Ser Ser Glu Val Gly Phe Val Asn Lys Ser Val Val Leu Leu Pro 525
AGC TTT TTC ACA TAC ACC GCT GTC AAT ATA ACC ATT GAT CTT GGT ATG 1632 Ser Phe Phe Thr Tyr Thr Thr Ala Val Asn Ile Thr Ile Asp Leu Gly Met 540
AAG CTT AGT GGT TAT GGT CAA CCC ATA GCC TCG ACA CTA AGT AAC ATC 1680 Lys Leu Ser Gly Tyr GGT Gly Gln Pro Ile Ala Ser Thr Thr Ser Asn Ile 555

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FIG. 5F

ACA CTA CCA ATG CAG GAT AAC AAT ACT GAT GTG TAC TGT ATT CGT TCT	1728
Thr Leu Pro Met Gln Asp Gln Asp Thr Thr Asp Val Tyr Cys Ile Arg Ser	575
AAC CAA TTC TCA GTT TAT GTT CAT TCC ACT TGC AAA AGT TCT TTA TGG	1776
Asn Gln Phe Ser Val Tyr Tyr Val His Ser Thr Thr Cys Ser Leu Trp	590
GAC AAT ATT TTT AAT CAA GAC TGC ACG GAT GTT TTA GAG GCT ACA GCT	1824
Asp Asn Ile Phe Asn Gln Asp Cys Thr Thr Asp Val Leu Glu Ala Thr Ala	605
GTT ATA AAA ACT GGT ACT TGT CCT TTC TCA TTT GAT AAA TTG AAC AAT	1872
Val Ile Lys Thr Gly Thr Cys Pro Phe Ser Phe Asp Lys Leu Asn Asn	620
TAC TTG ACT TTT AAC ACG TTC TGT TTG TCG TTG AGT CCT GGT GGT GCT	1920
Tyr Leu Thr Phe Asn Thr Phe Cys Leu Ser Ser Leu Ser Pro Val Gly Ala	640
AAT TGC AAG TTT GAT GTT GCT GCA CGT ACA AGA ACC AAT GAG CAG GTT	1968
Asn Cys Lys Phe Asp Val Ala Ala Arg Thr Arg Thr Asn Glu Gln Val	655
GTT AGA AGT CTA TAT ATA ATA TAT GAA GAA GGA GAC AAC ATA GTG GGT	2016
Val Arg Ser Leu Tyr Ile Ile Tyr Glu Glu Gly Asp Asn Ile Val Gly	670

A*

Lys*
630

G*

Val*
660

FIG. 5G

GTA CCG TCT GAT GAT AGC GGT CTG CAC GAT TTG TCT GTG CTA CAC CTA	2064
Val Pro Ser Asp Asp Ser Gly Leu His Asp Leu Ser Val His Leu	685
GAC TCC TGT ACA GAT TAC AAT ATA TAT GGT AGA ACT GGT GGT ATT	2112
Asp Ser Cys Thr Asp Tyr Asn Ile Tyr Gly Arg Thr Gly Val Gly Ile	700
ATT AGA CGA ACT AAC AGT ACG CTA CTT AGT GGC TTA TAT TAC ACA TCA	2160
Ile Arg Arg Thr Asn Ser Thr Leu Leu Ser Gly Leu Tyr Thr Ser	720
CTA TCA GGT GAT TTG TTA GGC TTT AAA AAT GTT AGT GAT GGT GTC ATT	2208
Leu Ser Gly Asp Leu Leu Gly Phe Lys Asn Val Ser Asp Gly Val Ile	735
TAT TCT GTG ACG CCA TGT GAT GTA AGC GCA CAA GCG GCT GGT ATT GAT	2256
Tyr Ser Val Thr Pro Cys Asp Val Ser Ala Gln Ala Val Ile Asp	750
GGT GCC ATA GTT GGA GCT ATG ACT TCC ATT AAC AGT GAA CTG TTA GGT	2304
Gly Ala Ile Val Gly Ala Met Thr Ser Ile Asn Ser Glu Leu Gly	765
CTA ATA CAT TGG ACA ACG ACA CCT AAT TTT TAT TAC TCT ATA TAT	2352
Leu Ile His Trp Thr Thr Thr Pro Asn Phe Tyr Tyr Ser Ile Tyr	780
AAT TAC ACA AGT GAG AGG ACT CGT GGC ACT GCA ATT GAC AGT AAC GAT	2400
Asn Tyr Thr Ser Glu Arg Thr Arg Gly Thr Ala Ile Asp Ser Asn Asp	800

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FIG. 5H

GTT GAT TGT GAA CCT GTC ATA ACC TAT TCT AAT ATA GGT GTT TGT AAA 2448	Val Asp Cys Glu Pro 805	Tyr Thr	Ser Asn Ile Gly Val Cys Lys 815
AAT GGT GCT TTG GTT TTT ATT AAC GTC ACA CAT TCT GAC GAC GTG 2496	Asn Gly Ala Leu Val 820	Val Ile Asn Val Thr His Ser Asp Gly Asp Val 830	
CAA CCA ATT AGC ACT GGT AAT GTC ACG ATA CCT ACA AAT TTT ACC ATA 2544	Gln Pro Ile Ser Thr Gly Asn Val 835	Thr Ile Pro Thr Asn Phe Thr Ile 845	
TCT GTG CAA GTT GAA TAC ATG CAG GTT TAC ACT ACA CCA GTA TCA ATA 2592	Ser Val Gln Val Glu Tyr Met 855	Tyr Thr Thr Pro Val Ser Ile 860	
GAT TGT GCA AGA TAC GTT TGT AAT GGT AAC CCT AGA TGT AAC AAA TTG 2640	Asp Cys Ala Arg Tyr Val 870	Asn Gly Asn Pro Arg Cys Asn Lys Leu 880	
TTA ACA CAA TAT GTG TCT GCA TGT CAA ACT ATT GAA CAA GCA CTT GCA 2688	Leu Thr Gln Tyr Val Ser 885	Gln Thr Ile Glu Gln Ala Leu Ala 895	
~TG GGT GCC AGA CTT GAA AAC ATG GAG GTT GAT TCC ATG TTG TTT GTC 2736	Met Gly Ala Arg Leu Glu Asn Met 900	Val Glu Val Asp Ser Met Leu Phe Val 910	
TCG GAA AAT GCC CTT AAA TTG GCA TCT GTT GAG GCG TTC AAT AGT ACA 2784	Ser Glu Asn Ala Leu Lys Leu Ala Ser 920	Val Glu Ala phe Asn Ser Thr 925	

FIG. 5I

GAA AAT TTA GAT CCT ATT TAC AAA GAA TGG CCT AGC ATA GGT TCT	2832
Glu Asn Leu Asp Pro Ile Tyr Lys Glu Trp Pro Ser Ile Gly Gly Ser	930 935 940
TGG CTA GGA GGT CTA AAA GAT ATA CTA CCG TCC CAT AAT AGC AAA CGT	2880
Trp Leu Gly Gly Leu Lys Asp Ile Leu Pro Ser His Asn Ser Lys Arg	945 950 955 960
AAG TAT GGT TCT GCT ATA GAA GAT TTG CTT TTT GAT AAA GTT GTA ACA	2928
Lys Tyr Gly Ser Ala Ile Glu Asp Leu Leu Phe Asp Lys Val Val Thr	965 970 975
TCT GGT TTA GGT ACA GTT GAT GAA GAT TAT AAA CGT TGT ACT GGT GGT	2976
Ser Gly Leu Gly Thr Val Asp Glu Asp Tyr Lys Arg Cys Thr Gly Gly	980 985 990
TAC GAC ATA GCA GAC TTG GTG TGT GCT CAA TAT TAC AAT GGC ATC ATG	3024
Tyr Asp Ile Ala Asp Leu Val Cys Ala Gln Tyr Tyr Asn Gly Ile Met	995 1000 1005
GTT CTA CCA GGT GTA GCT AAT GCT GAC AAG ATG ACT ATG TAC ACA GCA	3072
Val Leu Pro Gly Val Ala Asn Ala Asp Lys Met Thr Met Tyr Thr Ala	1010 1015 1020
TCA CTT GCA GGT GGT ATA ACA TTA GGT GCA CTT GGT GGC GCC GTG	3120
Ser Leu Ala Gly Gly Ile Thr Leu Gly Ala Leu Gly Gly Ala Val	1025 1030 1035 1040
GCT ATA CCT TTT GCA GTA GCA CAG GCT AGA CTT AAT TAT GGT GCT	3168
Ala Ile Pro Phe Ala Val Ala Val Gln Ala Arg Leu Asn Tyr Val Ala	1045 1050 1055

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FIG. 5J

CTA CAA ACT GAT GTA TTG AAT AAA AAC CAA CAG ATC CTG GCT AAT GCT 3216
 Leu Gln Thr Asp Val 1060
 1065

TTC AAT CAA GCT ATT GGT AAC ATT ACA CAG GCT TTT GGT AAG GTT AAT 3264
 Phe Asn Gln Ala Ile Gly Asn Ile Thr Gln Ala phe Gly Lys Val Asn
 1075 1080 1085

GAT GCT ATA CAT CAA ACA TCA CAA GGT CTT GCC ACT GTT GCT AAA GCG 3312
 Asp Ala Ile His Gln Thr Ser Gln Gly Leu Ala Thr Val Ala Lys Ala
 1090 1095 1100

TTG GCA AAA GTG CAA GAT GTT GTC AAC ACA CAA GGG CAA GCT TTA AGT 3360
 Leu Ala Lys Val Gln Asp Val 1110
 1105 1115

CAC CTT ACA GTA CAA TTG CAA AAT AAT TTT CAA GCC ATT AGT AGT TCT 3408
 His Leu Thr Val Gln Leu Gln Asn Asn Phe Gln Ala Ile Ser Ser Ser
 1125 1130 1135

ATT AGT GAT ATT TAT AAC AGG CTT GAC GAA CTG AGT GCT GAT GCA CAA 3456
 Ile Ser Asp Ile Tyr Asn Arg Leu Asp Glu Leu Ser Ala Asp Ala Gln
 1140 1145 1150

GTT GAT AGG CTG ATT ACA GGT AGA CTT ACA GCA CTT AAT GCA TTT GTG 3504
 Val Asp Arg Leu Ile Thr Gly Arg Leu Thr Ala Leu Asn Ala Phe Val
 1155 1160 1165

TCT CAG ACT CTA ACC AGA CAA GCA GAG GTT AGG GCT AGT AGA CAA CTT 3552
 Ser Gln Thr Leu Thr Arg Gln Ala Glu Val Arg Ala Ser Arg Gln Leu
 1170 1175 1180

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FIG. 5K

GCC AAA GAC AAG GTT AAT GAA TGT GTT AGG TCT CAG TCT CAG AGA TTC 3600
 Ala Lys Asp Lys Val Asn Glu Cys Val Arg Ser Gln Ser Gln Arg Phe 1200
 1185 1190 1195
 GGA TTC TGT GGT AAT GGT ACA CAT TTG TTT TCA CTA GCA AAT GCA GCA 3648
 Gly Phe Cys Gly Asn Gly Thr His Leu Phe Ser Leu Ala Asn Ala Ala 1215
 1205 1210 1215
 CCA AAT GGC ATG ATT TTC TTT CAT ACA GTA CTA TTA CCA ACA GCT TAT 3696
 Pro Asn Gly Met Ile Phe Phe His Thr Val Leu Leu Pro Thr Ala Tyr 1230
 1220 1225 1230
 GAA ACT GTA ACA GCT TGG TCA GGT ATT TGT GCT TCA GAT GGC GAT CGC 3744
 Glu Thr Val Thr Ala Trp Ser Gly Ile Cys Ala Ser Asp Gly Asp Arg 1245
 1235 1240 1245
 ACT TTC GGA CTT GTC GTT AAA GAT GTG CAG TTG ACG TTG TTT CGT AAT 3792
 Thr Phe Gly Leu Val Val Lys Asp Val Gln Leu Thr Leu Phe Arg Asn 1260
 1250 1255 1260
 CTA GAT GAC AAG TTC TAT TTG ACC CCC AGA ACT ATG TAT CAG CCT AGA 3840
 Leu Asp Asp Lys Phe Tyr Leu Thr Pro Arg Thr Met Tyr Gln Pro Arg 1280
 1265 1270 1275 1280
 GTT GCA ACT AGT TCT GAT TTT GTT CAA ATT GAA GGG TGT GAT GTG TTG 3888
 Val Ala Thr Ser Ser Asp Phe Val Gln Ile Glu Gly Cys Asp Val Leu 1295
 1285 1290 1295
 TTT GTC AAC GAG ACT GTA ATT GAT TTG CCT AGT ATT ATA CCT GAC TAT 3936
 Phe Val Asn Ala Thr Val Ile Asp Leu Pro Ser Ile Ile Pro Asp Tyr 1310
 1300 1305 1310

FIG. 5L

ATT GAC ATT AAT CAA ACT GTT CAA GAC ATA TTA GAA AAT TAC AGA CCA 3984
 Ile Asp Ile Asn Gln Thr Val Gln Asp Ile Leu Glu Asn Tyr Arg Pro
 1315 1320

 AAC TGG ACT GTA CCT GAA TTT ACA CTT GAT ATT TTC AAC ACA ACC TAT 4032
 Asn Trp Thr Val Pro Glu Glu Phe Thr Leu Asp Ile Phe Asn Thr Thr Tyr
 1330 1335 1340

 TTA AAT CTG ACT GGT GAA ATT GAT GAC TTA GAG TTT AGG TCG GAA AAG 4080
 Leu Asn Leu Thr Gly Thr Val Glu Ile Asp Asp Leu Glu Phe Arg Ser Glu Lys
 1345 1350 1355

 CTA CAT AAC ACT ACA GTA GAA CTT GCC ATT CTC ATT GAT AAC ATT AAT 4128
 Leu His Asn Thr Thr Val Glu Glu Leu Ala Ile Leu Ile Asp Asn Ile Asn
 1365 1370 1375

 AAT ACA TTA GTC AAT CTT GAA TGG CTC AAT AGA ATT GAA ACT TAT GTA 4176
 Asn Thr Leu Val Asn Leu Glu Trp Leu Asn Arg Ile Glu Thr Tyr Val
 1380 1385 1390

 AAA TGG CCT TGG TAT GTG TGG CTA CTG ATA GGT TTA GTA GTA TTT 4224
 Lys Trp Pro Trp Tyr Val Trp Leu Trp Leu Ile Gly Leu Val Val Val Phe
 1395 1400 1405

 TGC ATA CCA TTA CTG CTA TTT TGC TGT TTT AGC ACA GGT TGT TGT GGA 4272
 Cys Ile Pro Leu Leu Leu Phe Cys Cys Phe Ser Thr Gly Cys Cys Gly
 1410 1415 1420

 TGC ATA GGT TGT TTA GGA AGT TGT TGT CAC TCT ATA TGT AGT AGA AGA 4320
 Cys Ile Gly Cys Leu Gly Ser Cys Cys His Ser Ile Cys Ser Arg Arg
 1425 1430 1435 1440

 CAA TTT GAA AAT TAT GAA CCA ATT GAA AAA GTG CAT GTC CAC 4362
 Gln Phe Glu Asn Tyr Glu Pro Ile Glu Lys Val His Val His
 1445 1450

 TAA 4365

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FIG. 6

TN406, nucleotides 302 - 671 [SEQ ID NO:29]
TN406, amino acids 102 - 223 [SEQ ID NO:30]

GT	GGT	AAA	CCA	TTA	TTT	CAT	GTG	CAT	GGT	GAG	CCT	339
	Gly	Lys	Pro	Leu	Leu	Phe	His	Val	His	Gly	Glu	Pro
												111
GTT	AGT	GTT	ATT	ATA	TAT	ATA	TGG	GCT	TAT	AGG	GAT	378
	Val	Ser	Val	Ile	Ile	Tyr	Ile	Ser	Ala	Tyr	Arg	Asp
												116
												121
GTG	CAA	CAA	AGG	CCC	CTT	TTA	AAA	CAT	GGG	TTA	GTG	TGC
	Val	Gln	Gln	Arg	Pro	Leu	Leu	Lys	His	Gly	Leu	Val
												136
ATA	ACT	AAA	AAT	CGC	CAT	ATT	AAC	TAT	GAA	CAA	TTC	ACC
	Ile	Thr	Lys	Asn	Arg	His	Ile	Asn	Tyr	Gln	Phe	Thr
												141
												146
TCC	AAC	CAG	TGG	AAT	TCC	ACA	TGT	ACG	GGT	GCT	GAC	AGA
	Ser	Asn	Gln	Trp	Asn	Ser	Thr	Cys	Thr	Gly	Ala	Asp
												161
AAA	ATT	CCT	TTC	TCT	GTC	ATA	CCC	ACG	GAC	AAT	GGA	ACA
	Lys	Ile	Pro	Phe	Ser	Val	Ile	Pro	Thr	Asp	Asn	Gly
												176
AAA	ATC	TAT	GAT	CTT	GAG	TGG	AAT	GAT	GAC	TTT	GTT	ACA
	Lys	Ile	Tyr	Gly	Leu	Glu	Trp	Asn	Asp	Phe	Val	Thr
												181
												186
GCT	TAT	ATT	AGT	GGT	CGT	TCT	TAT	CAC	TTG	AAC	ATC	AAT
	Ala	Tyr	Ile	Ser	Gly	Arg	Ser	Tyr	His	Leu	Asn	Ile
												201
ACT	AAT	TGG	TTT	AAC	AAT	GTC	ACA	CTT	TTG	TAT	TCA	CGC
	Thr	Asn	Trp	Phe	Asn	Val	Thr	Leu	Leu	Tyr	Ser	Arg
												216
												211
TCA	AGC	ATT	GCT	ACC	TGG	GA						
	Ser	Ser	Ile	Ala	Thr	Trp						
												221

671

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FIG. 7A

FECV, Nucleotides 1- 4365 [SEQ ID NO:31]
 FECV, amino acids 1- 1454 [SEQ ID NO:32]

ATG	ATT	GTG	CTC	GTA	ACT	TGC	CTC	TTG	TTG	TTA	TGC	TCG	TAC	CAC	ACT	48
Met	Ile	Val	Leu	Val	Thr	Cys	Leu	Leu	Leu	Leu	Cys	Ser	Tyr	His	Thr	
1				5				10						15		
GTT	TCG	AGT	ACG	TCA	AAC	AAT	GAT	TGT	AGA	CAA	GTT	AAC	GTA	ACA	CAA	96
Val	Ser	Ser	Thr	Ser	Asn	Asn	Asp	Cys	Arg	Gln	Val	Asn	Val	Thr	Gln	
				20				25					30			
TTA	GCT	GGC	AAT	GAA	AAC	CTT	ATT	AGA	GAC	TTT	TTG	TTT	CAA	AGT	TTT	144
Leu	Ala	Gly	Asn	Glu	Asn	Leu	Ile	Arg	Asp	Phe	Leu	Phe	Gln	Ser	Phe	
		35					40					45				
AAA	GAA	GAA	GGA	ATT	GTA	GTT	GTT	GGT	GGT	TAT	TAC	CCT	ACA	GAG	GTG	192
Lys	Glu	Glu	Gly	Ile	Val	Val	Val	Gly	Gly	Tyr	Tyr	Pro	Thr	Glu	Val	
		50				55					60					
TGG	TAC	AAC	TGC	TCT	AGA	ACA	GCA	ACT	ACC	ACT	GCC	TAT	GAG	TAT	TTT	240
Trp	Tyr	Asn	Cys	Ser	Arg	Thr	Ala	Thr	Thr	Thr	Ala	Tyr	Glu	Tyr	Phe	
65					70					75					80	
AAT	AAT	ATA	CAT	GCC	TTT	TAT	TTT	GAT	ATG	GAA	GCT	ATG	GAA	AAT	AGC	288
Asn	Asn	Ile	His	Ala	Phe	Tyr	Phe	Asp	Met	Glu	Ala	Met	Glu	Asn	Ser	
				85				90						95		
ACT	GGT	AAT	GCA	CGT	GGT	AAA	CCT	CTA	TTA	TTT	CAT	GTT	CAT	GGT	GAA	336
Thr	Gly	Asn	Ala	Arg	Gly	Lys	Pro	Leu	Leu	Phe	His	Val	His	Gly	Glu	
↑		100					105						110			
97 of WSU 1146 amino acid #62 of AR58-3																

97 of WSU 1146
 amino acid #62 of AR58-3

FIG. 7B

CCT GTT AGT ATC ATC ATA TAT ATA TCA GCT TAT GGG GAT GAT GTG CAA 384
Pro Val Ser Ile Ile Ile Ile Ile Ile Ile Ile Ile Ile Ile Ile Ile Ile Ile Ile
115 120 125
CAA AGG CCA CTT TTA GAA CAT GGG TTA TTG TGC ATT ACT AAA AAT CGC 432
Gln Arg Pro Leu Leu Glu His Gly Leu Leu Cys Ile Thr Lys Asn Arg
130 135 140
AAT ATT GAC TAT AAC ACC TTC ACC AGC AAC CAG TGG GAT TCC ATA TGT 480
Asn Ile Asp Tyr Asn Thr Phe Thr Ser Ser Asn Gln Trp Asp Ser Ile Cys
145 150 155 160
ACG GGT AAT GAC AGA AAA ATT CCT TTC TCT GTC ATA CCC AGG GAT AAT 528
Thr Gly Asn Asp Arg Lys Ile Pro Phe Ser Val Ile Ile Pro Arg Asp Asn
165 170 175
GGA ACA AAA ATC TAT GGG CTT GAG TGG AAT GAT GAA TTT GTT ACA GCG 576
Gly Thr Lys Ile Tyr Gly Leu Glu Trp Trp Asn Asp Glu Phe Val Thr Ala
180 185 190
TAT ATT AGT GGT CGT TCT TAT AAT TGG AAC ATC AAT AAT AAC TGG TTT 624
Tyr Ile Ser Gly Arg Ser Tyr Asn Trp Asn Ile Asn Asn Asn Trp Phe
195 200 205
AAC AAT GTC ACA CTT TTG TAT TCA CGC TCA AGC ACT GCT ACC TGG GAA 672
Asn Asn Val Thr Leu Leu Tyr Tyr Ser Ser Thr Ala Thr Trp Glu
210 215 220

FIG. 7C

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TAC AGT GCT GCA TAT GTT TAC CAA GGT GTT TCT AAC TTC ACT TAT TAC	720
Tyr Ser Ala Ala Tyr Val Val Tyr Gln Gly Val Ser Asn Phe Thr Tyr	240
225	
AAG TTA AAT AAC ACC AAT GGT TTA AAA ACC TAT GAA TTT TGT GAG GAT	768
Lys Leu Asn Asn Thr Asn Gly Tyr Leu Lys Thr Tyr Glu Phe Cys Glu Asp	255
245	
TAT GAA TAT TGC ACT GGC TAC GCC ACT AAT AAT GTC TTT GCT CCA ACT GTG	816
Tyr Glu Tyr Tyr Cys Thr Gly Tyr Ala Thr Asn Val Phe Ala Pro Thr Val	270
260	
GGA GGT TAC ATA CCT GAT GGA TTT AGT TTT AAC AAT AAT TGG TTT TTG CTT	864
Gly Gly Tyr Ile Pro Asp Gly Phe Ser Ser Phe Asn Asn Trp Phe Leu Leu	285
275	
ACA AAT AGC TCC ACT TTT CTT AGT GGC AGA TTT GTA ACA AAC CAA CCA	912
Thr Asn Ser Ser Thr Phe Val Val Ser Gly Arg Phe Val Thr Asn Gln Pro	300
290	
CTA TTA GTT AAC TGC TTA TGG CCA GTG CCC AGT AGT TTT GGT GTA GCA GCA	960
Leu Leu Val Asn Cys Leu Trp Pro Val Pro Ser Ser Phe Gly Val Ala Ala	320
305	
CAA GAA TTT TGT TTT GAA GGT GCG CAG TTT AGT CAG TGT AGT GGT GTA	1008
Gln Glu Phe Cys Phe Glu Gly Ala Gln Phe Ser Ser Gln Cys Ser Gly Val	335
325	
TCT TTA AAT AAC ACA GTA GAT GAT ATT AGA TTC AAT AAT CTT AAT TTC ACC	1056
Ser Leu Asn Asn Thr Val Asp Val Ile Arg Phe Asn Leu Asn Phe Thr	345
340	

FIG. 7D

GCA GAT GTA CAA TCT GGT ATG GGT GCT ACA GTG TTT TCG TTG AAT ACA	1104
Ala Asp Val Gln Ser Gly Met Gly Ala Thr Val Phe Ser Leu Asn Thr	365
ACG GGT GGT GTC ATT CTT GAA GTT TCA TGT TAT AAT GAC ACA GTG AGT	1152
Thr Gly Gly Val Ile Leu Glu Val Ser Cys Tyr Asn Asp Thr Val Ser	380
GAG TCT AGT TTT TAC AGT TAT GGT GAA ATT CCG TTC GGC ATA ACT GAT	1200
Glu Ser Ser Phe Tyr Ser Tyr Gly Glu Ile Pro Phe Gly Ile Thr Asp	400
GGA CCA CGG TAC TGT TAT GTA CTT TAC AAT GGC ACA GCT CTT AAG TAT	1248
Gly Pro Arg Tyr Cys Tyr Val Leu Tyr Asn Gly Thr Ala Leu Lys Tyr	415
TTA GGA ACA TTA CCA CCT AGT GTA AAG GAA ATT GCT ATT AGT AAG TGG	1296
Leu Gly Thr Leu Pro Pro Ser Val Lys Glu Ile Ala Ile Ser Lys Trp	430
GGC CAT TTT TAT ATT AAT GGT TAC AAT TTC TTT AGC ACA TTT CCT ATT	1344
Gly His Phe Tyr Ile Asn Gly Tyr Asn Phe Phe Ser Thr Phe Pro Ile	445
GAT TGT ATA TCT TTT AAC TTA ACC ACT GGT GAT AGT GGA GCT TTT TGG	1392
Asp Cys Ile Ser Phe Asn Leu Thr Thr Gly Asp Ser Ser Gly Ala Phe Trp	460
ACA ATT GCT TAC ACA TCG TAC ACT GAG GCA TTA GTA CAA GTT GAA AAC	1440
Thr Ile Ala Tyr Thr Ser Tyr Thr Glu Ala Leu Val Gln Val Glu Asn	480

FIG. 7E

ACA GCT ATT AAA AAG GTG ACG TAT TGT AAC AGT CAC ATT AAT AAC ATT	1488
Thr Ala Ile Lys 485 Lys Thr Val Thr Tyr Cys Asn 490 Ser His Ile Asn 495 Ile	
AAG TGT TCT CAA CTT ACT GCT AAT TTG AAT AAT GGA TTT TAT CCT GTT	1536
Lys Cys Ser Gln 500 Leu Thr Ala Asn Leu Asn Asn Gly Phe Tyr Pro Val 510	
GCT TCA AGT GAG GGT GGT CTT GTG AAT AAG AGT GTT GTG TTA TTA CCT	1584
Ala Ser 515 Ser Glu Val Val Gly Leu 520 Val Val Leu Leu Pro 525	
ATC TTT TTC GCA CAT ACC GCT ATC AAT ATA ACC ATT GAT CTT GGT ATG	1632
Ile Phe 530 Phe Ala His Thr 535 Ala Ile Asn Ile Thr 540 Ile Asp Leu Gly Met	
AAG CGT AGC GGT TAT GGT CAA CCC ATA GCA TCA ACA TTA AGT AAC ATT	1680
Lys Arg Ser Gly Tyr 550 Gly Gln Pro Ile Ala Ser Thr Leu Ser Asn 560 Ile 565	
ACA CTA CCA ATG CAG GAT AAT AAC ACA GAT GTG TAC TGT ATT CGT TCT	1728
Thr Leu Pro Met 565 Gln Asp Asn Thr Asp 570 Val Tyr Cys Ile Arg Ser 575	
AAC CAG TTT TCA GTT TAT GTT CAT TCT ATT TGT AAG AGT TCT TTA TGG	1776
Asn Gln Phe 580 Ser Val Tyr Val His Ser Ile Cys Lys Ser Ser Leu Trp 590 585	
GAC AAT ATT TTT AAT CAA GAA TGC ACG GAT GAT TTA GCC ACA GCT	1824
Asp Asn Ile Phe 595 Asn Gln Glu Cys Thr Asp Val Leu 600 Asp Ala Thr Ala 605	

FIG. 7F

GTT ATA AAG ACT GGT ACT TGT CCT TTC TCA TTT GAT AAA TTG AAC AAT 1872
Val Ile Lys Thr Gly Thr Cys Pro Phe Ser Phe Asp Lys Leu Asn Asn
610 615 620
TAC TTA ACT TTT AAC AAG TTC TGT TTG TCG TCG TTT GGT GGC GCT 1920
Tyr Leu Thr Phe Asn Lys Phe Cys Leu Ser Leu Ser Val Gly Ala
625 630 640
AAC TGC AAG TTT GAT GTT GCC GCA CGT ACA AGA ACC AAT GAG CAA GTT 1968
Asn Cys Lys Phe Asp Val Ala Ala Arg Thr Arg Thr Asn Glu Gln Val
645 650 655
GTT AGA AGT CTA TAT GTA ATA TAT GAA GAA GGA GAC AAC ATA GTT GGT 2016
Val Arg Ser Leu Tyr Val Ile Tyr Glu Glu Glu Gly Asp Asn Ile Val Gly
660 665 670
GTA CCG TCT GAT AAT AGC GGT CTG CAC GAT TTG TCT GTG CTA CAC CTA 2064
Val Pro Ser Asp Asn Ser Gly Leu His Asp Leu Ser Val Leu His Leu
675 680 685
GAC TCC TGT ACA GAG TAT AAT ATA TAT GGT AGA ACT GGT GGT ATT 2112
Asp Ser Cys Thr Glu Tyr Asn Ile Tyr Gly Arg Thr Gly Val Gly Ile
690 695 700
ATT AGA CAA ACT AAC AGT ACG CTA CTT AGC GGC TTA TAT TAC ACA TCA 2160
Ile Arg Gln Thr Asn Ser Thr Leu Leu Ser Gly Leu Tyr Thr Ser
705 710 715 720
CTA TCA GGT GAT TTG TTA GGC TTT AAA AAT GAT GGT GTC ATC 2208
Leu Ser Gly Asp Leu Leu Gly Phe Lys Asn Val Ser Asp Gly Val Ile
725 730 735

FIG. 7G

TAT Tyr	TCT Ser	GTG Val	ACG Thr	CCA Pro	TGT Cys	GAT Asp	GTA Val	AGC Ser	GCA Ala	CAA Gln	GCG Ala	4CT Ala	GTT Val	ATT Ile	GAT Asp	2256
		740						745					750			
GGT Gly	GCC Ala	ATA Ile	GTT Val	GGA Gly	GCT Ala	ATG Met	ACT Thr	TCC Ser	ATT Ile	AAC Asn	AGT Ser	GAA Glu	CTG Leu	TTA Leu	GGT Gly	2304
		755					760					765				
CTA Leu	AAA Lys	CAC His	TGG Trp.	ACA Thr	ACA Thr	775	CCT Pro	AAT Asn	TTT Phe	TAT Tyr	TAC Tyr	TCT Tyr	TCT Ser	ATA Ile	TAT Tyr	2352
		770									780					
AAT Asn	TAT Tyr	ACA Thr	AAT Asn	GAG Glu	AGG Arg	790	CGT Arg	GGC Gly	ACT Thr	GCA Ala	ATT Ile	GAC Asp	AGT Ser	AAC Asn	GAT Asp	2400
		785								795					800	
GTT Val	GAT Asp	TGT Cys	GAA Glu	CCT Pro	ATC Ile	805	ACC Thr	TAT Tyr	TCT Ser	AAC Asn	ATA Ile	GGT Gly	GTT Val	TGT Cys	AAA Lys	2448
									810					815		
AAT Asn	GGT Gly	GCT Ala	TTG Leu	GTT Val	TTT Phe	820	AAC Asn	GTC Val	ACA Thr	CAT His	TCT Ser	GAT Asp	GGA Gly	GAC Asp	GTG Val	2496
								825					830			
CAA Gln	CCA Pro	ATT Ile	AGC Ser	ACT Thr	GGT Gly	835	GTC Val	ACG Thr	ATA Ile	CCT Pro	ACA Thr	AAC Asn	TTT Phe	ACC Thr	ATA Ile	2544
								840				845				
TCT Ser	GTG Val	CAA Gln	GTC Val	GAA Glu	TAC Tyr	850	ATT Ile	CAG Val	ACC Tyr	CCT Thr	ACA Thr	CCA Pro	GTA Val	TCA Ser	ATA Ile	2592
							855					860				

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FIG. 7H

GAT TGT GCA AGA TAC GTT TGC AAT GGT AAC CCT AGA TGT AAC AAA TTG	2640
Asp Cys Ala Arg Tyr Val Cys Asn Gly Asn Pro Arg Cys Asn Lys Leu	880
865	
TTA ACA CAA TAT GTT TCT GCA TGT CAA ACT ATT GAG CCA GCA CTT GCA	2688
Leu Thr Gln Tyr Val Ser Ala Cys Gln Thr Ile Glu Gln Ala Leu Ala	895
885	
ATG GGT GCC AGA CTT GAA AAC ATG GAG GTT GAT TCC ATG TTG TTC GTT	2736
Met Gly Ala Arg Leu Glu Asn Met Glu Val Asp Ser Met Leu Phe Val	910
900	
TCT GAA AAT GCC CTT AAA TTG GCA TCT GTT GAG GCG TTC AAT AGT ACA	2784
Ser Glu Asn Ala Leu Lys Leu Ala Ser Val Glu Ala Phe Asn Ser Thr	925
915	
GAA AAT TTA GAC CCT ATT TAC AAA GAA TGG CCT AAC ATA GGT GGT TCT	2832
Glu Asn Leu Asp Pro Ile Tyr Lys Glu Trp Pro Asn Ile Gly Gly Ser	940
930	
TGG TTA GGA GGT TTA AAA GAC ATA CTG CCG TCC CAT AAT AGC AAA CGT	2880
Trp Leu Gly Gly Leu Lys Asp Ile Leu Pro Ser His Asn Ser Lys Arg	960
945	
AAG TAT CGT TCT GCT ATA GAA GAC TTG CTT TTT GAT AAQ GTT GTA ACT	2928
Lys Tyr Arg Ser Ala Ile Glu Asp Leu Leu Phe Asp Lys Val Val Thr	975
965	
TCT GGT TTA GGT ACA GTT GAT GAA GAT TAT AAA CGT TGT ACA GGT GGT	2976
Ser Gly Leu Gly Thr Val Asp Glu Asp Tyr Lys Arg Cys Thr Gly Gly	990
980	

FIG. 7I

TAT GAC ATA GCC GAC TTA GTG TGT GCT CAA TAT TAC AIT GGC ATC ATG 3024
 Tyr Asp Ile Ala Asp Leu Val Cys Ala Gln Tyr Tyr Asn Gly Ile Met
 995 1000 1005

 GTG TTA CCT GGT GTA GCT AAT GAT GAC AAG ATG ACT ATG TAC ACA GCA 3072
 Val Leu Pro Gly Val Ala Asn Asp Asp Lys Met Thr Met Tyr Thr Ala
 1010 1015 1020

 TCT CTT GCA GGT GGT ATA ACA CTA GGT GCA CTT GGT GGT GGC GCC GTT 3120
 Ser Leu Ala Gly Gly Ile Thr Leu Gly Ala Leu Gly Gly Ala Val
 1025 1030 1035 1040

 GCT ATA CCT TTT GCA GTA GCA GTT CAA GCT AGA CTT AAT TAT GTT GCT 3168
 Ala Ile Pro Phe Ala Val Ala Val Gln Ala Arg Leu Asn Tyr Val Ala
 1045 1050 1055

 CTA CAA ACT GAT GTA TTG AAT AAA AAC CAG CAG ATC CTG GCT AAT GCT 3216
 Leu Gln Thr Asp Val Leu Asn Lys Asn Gln Gln Ile Leu Ala Asn Ala
 1060 1065 1070

 TTC AAT CAA GCT ATT GGT AAC ATT ACA CAG GCA TTT GGC AAG GTT AAT 3264
 Phe Asn Gln Ala Ile Gly Asn Ile Thr Gln Ala Phe Gly Lys Val Asn
 1075 1080 1085

 GAT GCT ATA CAT CAA ACA TCA AAA GGT CTT GCA ACT GTT GCT AAA GCA 3312
 Asp Ala Ile His Gln Thr Ser Lys Gly Leu Ala Thr Val Ala Lys Ala
 1090 1095 1100

 TTG GCA AAA GTG CAA GAT GTT GTC AAC ACA CAA GGG CAA GCT TTA AGC 3360
 Leu Ala Lys Val Gln Asp Val Val Asn Thr Gln Gly Gld Ala Leu Ser
 1105 1110 1115 1120

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FIG. 7J

CAC CTA ACA GTA CAA TTG CAA AAT AAT TTT CAA GCC ATT AGT AGC TCT	3408
His Leu Thr Val Gln Leu Gln Asn Asn Phe Gln Ala Ile Ser Ser	1125 1130 1135
ATT AGT GAT ATT TAT AAC AGG CTT GAC GAA CTG AGT GCT GAT GCA CAA	3456
Ile Ser Asp Ile Tyr Asn Arg Leu Asp Gln Leu Ser Ala Asp Ala Gln	1140 1145 1150
GTT GAT AGG CTG ATT ACA GGA AGA CTT ACA GCA CTT AAT GCA TTT GTG	3504
Val Asp Arg Leu Ile Thr Thr Arg Gly Arg Leu Thr Ala Leu Asn Ala Phe Val	1155 1160 1165
TCT CAG ACT CTA ACC AGA CAA GCG GAG GTT AGG GCT AGT AGA CAA CTT	3552
Ser Gln Thr Leu Thr Arg Gln Ala Gln Val Arg Ala Ser Arg Gln Leu	1170 1175 1180
GCC AAG GAC AAG GTT AAT GAA TGT GTT AGA TCC CAA TCT CAG AGA TTT	3600
Ala Lys Asp Lys Val Asn Gln Cys Val Arg Ser Gln Ser Gln Arg Phe	1185 1190 1195 1200
GGA TTC TGT GGT AAT GGT ACA CAC TTG TTT TCA CTT GCA AAT GCA GCA	3648
Gly Phe Cys Gly Asn Gly Thr His Leu Phe Ser Leu Ala Asn Ala Ala	1205 1210 1215
CCA AAT GGC ATG ATT TTC TTT CAT ACA GTG CTA TTA CCA ACG GCT TAT	3696
Pro Asn Gly Met Ile Phe Phe His Thr Val Leu Leu Pro Thr Ala Tyr	1220 1225 1230
GAA ACT GTA ACA GCT TGG CCA GGT ATT TGT GCT TCA GAT GGC GAT CGC	3744
Glu Thr Val Thr Ala Trp Pro Gly Ile cys Ala Ser Asp Gly Asp Arg	1235 1240 1245

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FIG. 7K

ACT TTT GGA CTT GTC GTT AAA GAT GTA CAG TTG ACG TTG TTT CGT AAC	3792
Thr Phe Gly Leu Val Val Lys Asp Val Gln Leu Thr Leu Phe Arg Asn	
1250	
CTA GAT GAC AAG TTC TAT TTG ACT CCC AGA ACT ATG TAT CAG CCT AGA	3840
Leu Asp Asp Lys Phe Tyr Leu Thr Thr Met Tyr Gln Pro Arg	
1265	
1270	
1275	
1280	
GCT GCA ACT AGT TCT GAT TTT GTT CAA ATT GAG GGG TGC GAT GTG TTG	3888
Ala Ala Thr Ser Ser Asp Phe Val Gln Ile Glu Gly Cys Asp Val Leu	
1285	
1290	
1295	
TTT GTC AAT GCA ACT GTA ATT GAC TTG CCT AGT ATT ATA CCT GAC TAT	3936
Phe Val Asn Ala Thr Val Ile Asp Leu Pro Ser Ile Ile Pro Asp Tyr	
1300	
1305	
1310	
ATT GAC ATC AAT CAG ACT GTT CAA GAT ATA TTA GAA AAT TAC AGA CCA	3984
Ile Asp Ile Asn Gln Thr Val Gln Asp Ile Leu Glu Asn Tyr Arg Pro	
1315	
1320	
1325	
AAC TGG ACT GTA CCT GAA TTG ACA CTT GAT ATT TTT AAC GCA ACC TAT	4032
Asn Trp Thr Val Pro Glu Leu Thr Leu Asp Ile Phe Asn Ala Thr Tyr	
1330	
1335	
1340	
TTA AAT CTG ACT GGT GAA ATT GAT GAC TTA GAA TTT AGG TCA GAA AAG	4080
Leu Asn Leu Thr Gly Glu Ile Asp Asp Leu Glu Phe Arg Ser Glu Lys	
1345	
1350	
1355	
1360	
CTA CAC AAT ACC ACT ACT GTA GAA CTT GCC ATT CTC ATT GAC AAC ATT AAC	4128
Leu His Asn Thr Thr Val Glu Leu Ala Ile Leu Ile Asp Asn Ile Asn	
1365	
1370	
1375	

FIG. 7L

AAC ACA TTA GTC AAT CTT GAA TGG CTC AAT AGA ATT GAA ACT TAT GTA	4176
Asn Thr Leu Val Trp Leu Glu Trp Leu Asn Arg Ile Glu Thr Tyr Val	1380 1385 1390
AAA TGG CCT TGG TAT TTG GTG TGG CTA CTA ATA GGC TTA GTA ATA TTT	4224
Lys Trp Pro Trp Tyr Val Trp Leu Leu Ile Gly Leu Val Val Ile Phe	1395 1400 1405
TGC ATA CCA TTA TTG CTA TTT TGC TGT AGT ACA GGT TGT TGT GGA	4272
Cys Ile Pro Leu Leu Leu Phe Cys Cys Cys Ser Thr Gly Cys Cys Gly	1410 1415 1420
TGC ATA GGT TGC TTA GGA AGT TGT TGT CAC TCT ATG TGT AGT AGA AGA	4320
Cys Ile Gly Cys Leu Leu Gly Ser Cys Cys His Ser Met Cys Ser Arg Arg	1425 1430 1435 1440
CAA TTT GAA AAT TAT GAA CCA ATT GAA AAA GTG CAT GTC CAC	4362
Gln Phe Glu Asn Tyr Glu Pro Ile Glu Lys Val His Val His	1445 1450
TAA	4365

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FIG. 8

UCD-2, nucleotides 1- 377 [SEQ ID NO:53]
 UCD-2, amino acids 1- 125 [SEQ ID NO:54]

AAT GCT CGT GGT AAA CCA TTA TTA TTT CAT GTG CAT GGT GAG CCT GTT	48
Asn Ala Arg Gly Lys Pro Leu Leu Phe His Val His Gly Glu Pro Val	15
1	
AGT GTT ATT ATA TAT ATA TCG GCT TAT AGG GAT GAT GTG CAA CAA AGG	96
Ser Val Ile Ile Tyr Ile Ser Ala Tyr Arg Asp Asp Val Gln Gln Arg	30
20	
CCC CTT TTA AAA CAT GGG TTA GTG TGC ATA ACT AAA AAT CGC CAT ATT	144
Pro Leu Leu Lys His Gly Leu Val Cys Ile Thr Lys Asn Arg His Ile	45
35	
AAC TAT GAA CAA TTC ACC TCC AAC CAG TGG AAT TCC ACA TGT ACG GGT	192
Asn Tyr Glu Gln Phe Thr Ser Asn Gln Trp Asn Ser Thr Cys Thr Gly	60
50	
GCT GAC AGA AAA ATT CCT TTC TCT GTC ATA CCC ACG GAC AAT GGA ACA	240
Ala Asp Arg Lys Ile Pro Phe Ser Val Ile Ile Pro Thr Asp Asn Gly Thr	80
65	
AAA ATC TAT GGT CTT GAG TGG AAT GAT GAC TTT GTT ACA GCT TAT ATT	288
Lys Ile Tyr Gly Leu Leu Tyr His Leu Trp Asn Asp Phe Val Thr Ala Tyr Ile	95
85	
AGT GGT CGT TCT TAT CAC TTG AAC ATC AAT ACT AAT TGG TTT AAC AAT	336
Ser Gly Arg Ser Tyr Ser Tyr His Leu Asn Ile Asn Thr Asn Trp Phe Asn Asn	110
100	
GTC ACA CTT TTG TAT TCA CGC TCA AGC ACT GCT ACC TGG GA	377
Val Thr Leu Leu Tyr Ser Arg Ser Ser Thr Ala Thr Trp	125
115	

FIG. 9A

Consensus Sequence		
Nucleotides 1- 2246	[SEQ ID NO:33]	
Amino acids 1- 748	[SEQ ID NO:34]	
ATG ATT GTG CTC GTA ACT TGC CTC TTG TTG TTA TGT TCA 39		
Met Ile Val Leu Val 5	Leu Leu 10	TGT Cys Ser
1		
TAC CAC ACA GTT TTG AGT ACA ACA AAT AAT GAA TGC ATA 78		
Tyr His Thr Val Leu Ser 20	Asn Asn Glu 25	Cys Ile
15		
CAA GTT AAC GTA ACA CAA TTG GCT GGC AAT GAA AAC CTT 117		
Gln Val Asn Val Thr Gln Leu Ala Gly 35	Glu Asn Leu	
30		
ATC AGA GAT TTT CTG TTT AGT AAC TTT AAA GAA GAA GGA 156		
Ile Arg Asp Phe Leu Phe Ser Asn Phe Lys 50	Glu Glu Gly	
40		
AGT GTA GTT GTT GGT GGT TAT TAC CCT ACA GAG GTG TGG 195		
Ser Val Val Val Gly 55	Tyr Tyr 60	Val Trp 65
TAC AAC TGC TCT AGA ACA GCT CGA ACT ACT GCC TTT CAG 234		
Tyr Asn Cys Ser Arg Thr Ala Arg Thr Thr 75	Ala Phe Gln	
70		
TAT TTT AAT AAT ATA CAT GCC TTT TAT TTT GTT ATG GAA 273		
Tyr Phe Asn Asn Ile His Ala Phe Tyr Phe Val 85	Met Glu 90	
80		

FIG. 9B

GCC ATG GAA AAT AGC ACT GGT AAT GCA CGT GGT AAA CCA 312	
Ala Met Glu Asn Ser Thr Gly Asn Ala Arg Gly Lys Pro	
	95 100
TTA TTA TTT CAT GTG CAT GGT GAG CCT GTT AGT GTT ATT 351	
Leu Leu Phe His Val His Gly Glu Pro Val Ser Val Ile	
105	110 115
ATA TAT ATA TCG GCT TAT AGG GAT GAT GTG CAA CAA AGG 390	
Ile Tyr Ile Ser Ala Tyr Arg Asp Asp Val Gln Gln Arg	
120	125 130
CCC CTT TTA AAA CAT GGG TTA GTG TGC ATA ACT AAA AAT 429	
Pro Leu Leu Lys His Gly Leu Val Cys Ile Thr Lys Asn	
	135 140
CGC CAT ATT AAC TAT GAA CAA TTC ACC TCC AAC CAG TGG 468	
Arg His Ile Asn Tyr Glu Gln Phe Thr Ser Asn Gln Trp	
145	150 155
AAT TCC ACA TGT ACG GGT GCT GAC AGA AAA ATT CCT TTC 507	
Asn Ser Thr Cys Thr Gly Ala Asp Arg Lys Ile Pro Phe	
	160 165
TCT GTC ATA CCC ACG GAC AAT GGA ACA AAA ATC TAT GGT 546	
Ser Val Ile Pro Thr Asp Asn Gly Thr Lys Ile Tyr Gly	
170	175 180
CTT GAG TGG AAT GAT GAC TTT GTT ACA GCT TAT ATT AGT 585	
Leu Glu Trp Asn Asp Phe Val Thr Ala Tyr Ile Ser	
185	190 195

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FIG. 9C

GGT CGT TCT TAT CAC TTG AAC ATC AAT ACT AAT TGG TTT	624
Gly Arg Ser Tyr His Leu Asn Ile Asn Thr Asn Trp Phe	
	200
	205
AAC AAT GTC ACA CTT TTG TAT TCA CGC TCA AGC ACT GCT	663
Asn Asn Val Thr Leu Leu Tyr Ser Arg Ser Thr Ala	
	210
	215
	220
ACC TGG GAA TAC AGT GCT GCA TAT GCT TAC CAA GGT GTT	702
Thr Trp Glu Tyr Ser Ala Ala Tyr Ala Tyr Gln Gly Val	
	225
	230
TCT AAC TTC ACT TAT TAC AAG TTA AAT AAC ACC AAT GGT	741
Ser Asn Phe Thr Tyr Tyr Lys Leu Asn Asn Thr Asn Gly	
	235
	240
	245
CTA AAA ACC TAT GAA TTA TGT GAA GAT TAT GAA CAT TGC	780
Leu Lys Thr Tyr Glu Leu Cys Glu Asp Tyr Glu His Cys	
	250
	255
ACT GGC TAT GCT ACC AAT GTA TTT GCT CCG ACA TCA GGT	819
Thr Gly Tyr Ala Thr Asn Val Phe Ala Pro Thr Ser Gly	
	260
	265
	270
GGT TAC ATA CCT GAT GGA TTT AGT TTT AAY AAT TGG TTC	858
Gly Tyr Ile Pro Asp Gly Phe Ser Phe Asn Asn Trp Phe	
	275
	280
	285

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FIG. 9D

TTG CTT ACA AAT AGT TCC ACT TTT GTT AGT GGC AGG TTT	897
Leu Leu Thr Asn Ser Ser Thr Phe Val Ser Gly Arg Phe	295
	290
GTA ACA AAT CAA CCA TTA TTG ATT AAT TGC TTG TGG CCA	936
Val Thr Asn Gln Pro Leu Leu Ile Asn Cys Leu Trp Pro	310
300	
GTG CCC AGT TTT GGT GTA GCA CAA GAA TTT TGT TTT	957
Val Pro Ser Phe Gly Val Ala Ala Gln Glu Phe Cys Phe	325
315	
GAA GGT GCA CAG TTT AGC CAA TGT AAT GGT GTG TCT TTA	1014
Glu Gly Ala Gln Phe Ser Gln Cys Asn Gly Val Ser Leu	335
330	
AAT AAC ACA GTG GAT GTT ATT AGA TTC AAC CTT AAT TTC	1053
Asn Asn Thr Val Asp Val Ile Arg Phe Asn Leu Asn Phe	350
340	
ACT GCA GAT GTA CAA TCT GGT ATG GGT GCT ACA GTA TTT	1092
Thr Ala Asp Val Gln Ser Gly Met Gly Ala Thr Val Phe	360
355	
TCA CTG AAT ACA ACA GGT GGT GTC ATT CTT GAA ATT TCA	1131
Ser Leu Asn Thr Thr Gly Gly Val Ile Leu Glu Ile Ser	375
365	
TGT TAT AGT GAC ACA GTG AGT GAG TCT AGT TCT TAC AGT	1170
Cys Tyr Ser Asp Thr Val Ser Glu Ser Ser Tyr Ser	385
380	
	390

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FIG. 9E

TAT GGT GAA ATC CCG TTC GGC ATA ACT GAC GGA CCA CGA	1209
Tyr Gly Glu Ile Pro Phe Gly Ile Thr Asp Gly Pro Arg	400
TAC TGT TAT GTA CTT TAC AAT GGC ACA GCT CTT AAA TAT	1248
Tyr Cys Tyr Val Leu Tyr Asn Gly Thr Ala Leu Lys Tyr	415
TTA GGA ACA TTA CCA CCC AGT GTA AAG GAA ATT GCT ATT	1287
Leu Gly Thr Leu Pro Pro Ser Val Lys Glu Ile Ala Ile	425
AGT AAG TGG GGC CAT TTT TAT ATT AAT GGT TAC AAT TTC	1326
Ser Lys Trp Gly His Phe Tyr Ile Asn Gly Tyr Asn Phe	440
TTT AGC ACA TTT CCT ATT GRT TGT ATA TCT TTT AAT TTA	1365
Phe Ser Thr Thr Phe Pro Ile Xaa Cys Ile Ser Phe Asn Leu	455
ACC ACT GGT GTT AGT GGA GCT TTT TGG ACA ATT GCT TAC	1404
Thr Thr Gly Val Ser Gly Ala Phe Trp Thr Thr Ala Tyr	465
ACA TCG TAT ACT GAA GCA TTA GTA CAA GTT GAA AAC ACA	1443
Thr Ser Tyr Thr Glu Ala Leu Val Gln Val Glu Asn Thr	480
GCT ATT AAA AAT GTG ACG TAT TGT AAC AGT CAC ATT AAT	1482
Ala Ile Lys Asn Val Thr Tyr Cys Asn Ser His Ile Asn	490

FIG. 9F

AAC ATT AAA TGT TCT CAA CTT ACT GCT AAT TTG AAT AAT 1521
Asn Ile Lys Cys Ser Gln Leu Thr Ala Asn Leu Asn Asn
495 500 505
GGA TTT TAT CCT GTT GCT TCA AGT GAA GTA GGT TTC GTT 1560
Gly Phe Tyr Pro Val Ala Ser Ser Glu Val Gly Phe Val
510 515 520
AAT AAG AGT GTT GTG TTA CTT AGC TTT TTC ACA TAC 1599
Asn Lys Ser Val Val Leu Leu Pro Ser Phe Thr Tyr
530
ACC GCT GTC AAT ATA ACC ATT GAT CTT GGT ATG AAG CTT 1638
Thr Ala Val Asn Ile Thr Ile Asp Leu Gly Met Lys Leu
535 540 545
AGT GGT TAT GGT CAA CCC ATA GCC TCG ACA CTA AGT AAC 1677
Ser Gly Tyr Gly Gln Pro Ile Ala Ser Thr Leu Ser Asn
550 555
ATC ACA CTA CCA ATG CAG GAT AAC AAT ACT GAT GTG TAC 1716
Ile Thr Leu Pro Met Gln Asp Asn Asn Thr Asp Val Tyr
560 565 570
TGT ATT CGT TCT AAC CAA TTC TCA GTT TAT GTT CAT TCC 1755
Cys Ile Arg Ser Asn Gln Phe Ser Val Tyr Val His Ser
575 580 585
ACT TGC AAA AGT TCT TTA TGG GAC AAT ATT TTT AAT CAA 1794
Thr Cys Lys Ser Ser Leu Trp Asp Asn Ile Phe Asn Gln
590 595

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FIG. 9G

GAC TGC	ACG	GAT	GTT	TTA	GAG	GCT	ACA	GCT	GTT	ATA	AAA	1833
Asp Cys	Thr	Asp	Val	Leu	Glu	Ala	Thr	Ala	Val	Ile	Lys	
600					605					610		
ACT GGT	ACT	TGT	CCT	TTC	TCA	TTT	GAT	AAA	TTG	AAC	AAT	1872
Thr Gly	Thr	Cys	Pro	Phe	Ser	Phe	Asp	Lys	Leu	Asn	Asn	
		615					620					
TAC TTG	ACT	TTT	AAC	AAG	TTC	TGT	TTG	TCG	TTG	AGT	CCT	1911
Tyr Leu	Thr	Phe	Asn	Lys	Phe	Cys	Leu	Ser	Leu	Ser	Pro	
625				630					635			
GTT GGT	GCT	AAT	TGC	AAG	TTT	GAT	GTT	GCT	GCA	CGT	ACA	1950
Val Gly	Ala	Asn	Cys	Lys	Phe	Asp	Val	Ala	Ala	Arg	Thr	
	640					645					650	
AGA ACC	AAT	GAG	CAG	GTT	GTT	AGA	AGT	CTA	TAT	GTA	ATA	1989
Arg Thr	Asn	Glu	Gln	Val	Val	Arg	Ser	Leu	Tyr	Val	Ile	
			655					660				
TAT GAA	GAA	GGA	GAC	AAC	ATA	GTG	GGT	GTA	CCG	TCT	GAT	2028
Tyr Glu	Glu	Gly	Asp	Asn	Ile	Val	Gly	Val	Pro	Ser	Asp	
665					670					675		
RAT AGC	GGT	CTG	CAC	GAT	TTG	TCT	GTG	CTA	CAC	CTA	GAC	2067
Xaa Ser	Gly	Leu	His	Asp	Leu	Ser	Val	Leu	His	Leu	Asp	
		680					685					
TCC TGT	ACA	GAT	TAC	AAT	ATA	TAT	GGT	AGA	ACT	GGT	GTT	2106
Ser Cys	Thr	Asp	Tyr	Asn	Ile	Tyr	Gly	Arg	Thr	Gly	Val	
690				695					700			

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FIG. 9H

GGT ATT ATT AGA CGA ACT AAC AGT ACG CTA CTT AGT GGC	2145
Gly Ile Ile Arg Arg Thr Asn Ser Thr Leu Ser Gly	715
TTA TAT TAC ACA TCA CTA TCA GGT GAT TTG TTA GGC TTT	2184
Leu Tyr Tyr Thr Ser Ser Leu Ser Gly Asp Leu Leu Gly Phe	725
AAA AAT GTT AGT GAT GGT GTC ATT TAT TCT GTG ACG CCA	2223
Lys Asn Val Ser Asp Gly Val Ile Tyr Ser Val Thr Pro	735
TGT GAT GTA AGC GCA CAA GCG GC	2246
Cys Asp Val Ser Ala Gln Ala	745